

Documenting stream response to hydromodification in a sandy watershed, Gobernadora Canyon, Orange County, California



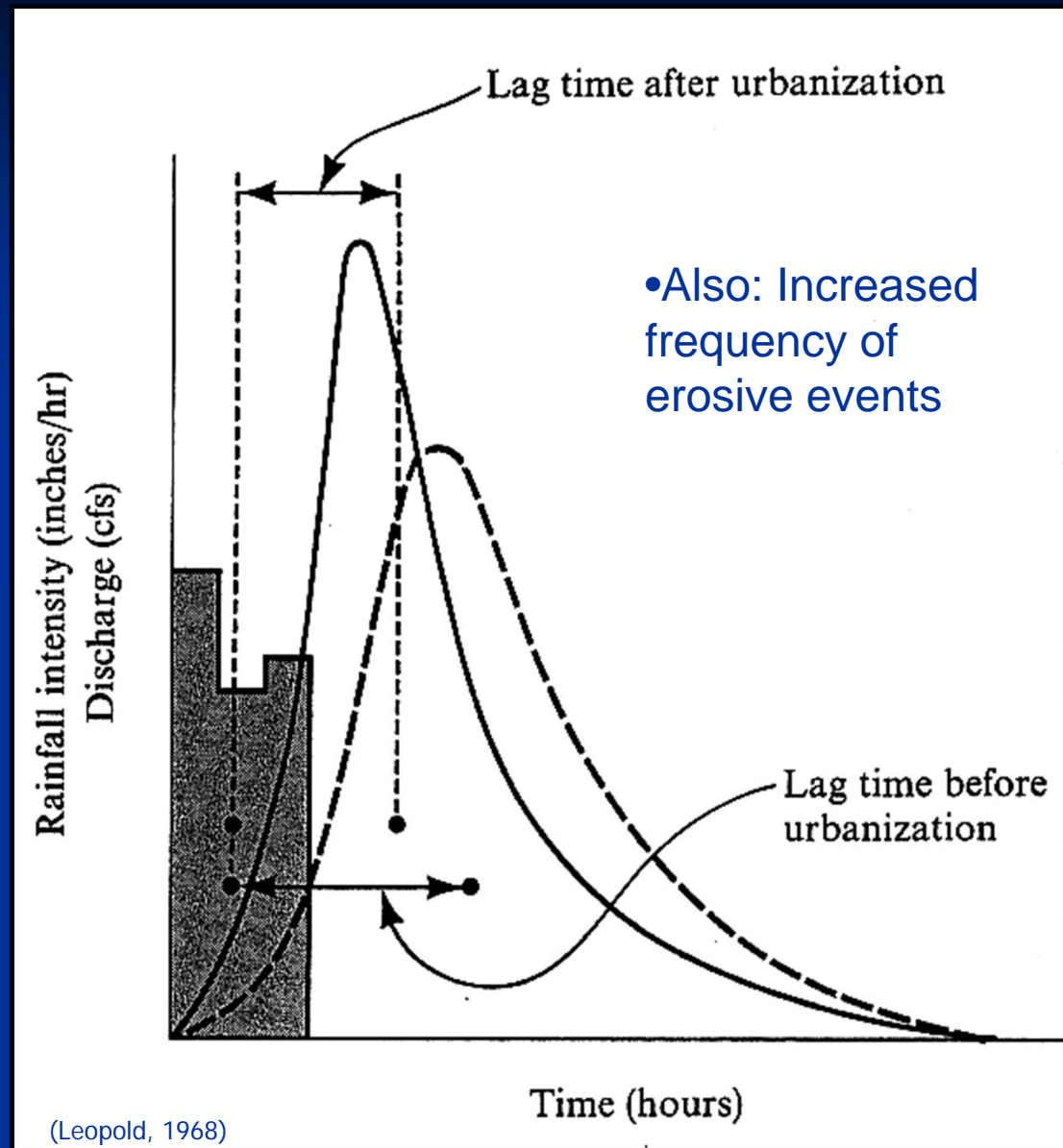
Scott Brown and
Barry Hecht



Balance
Hydrologics, Inc.

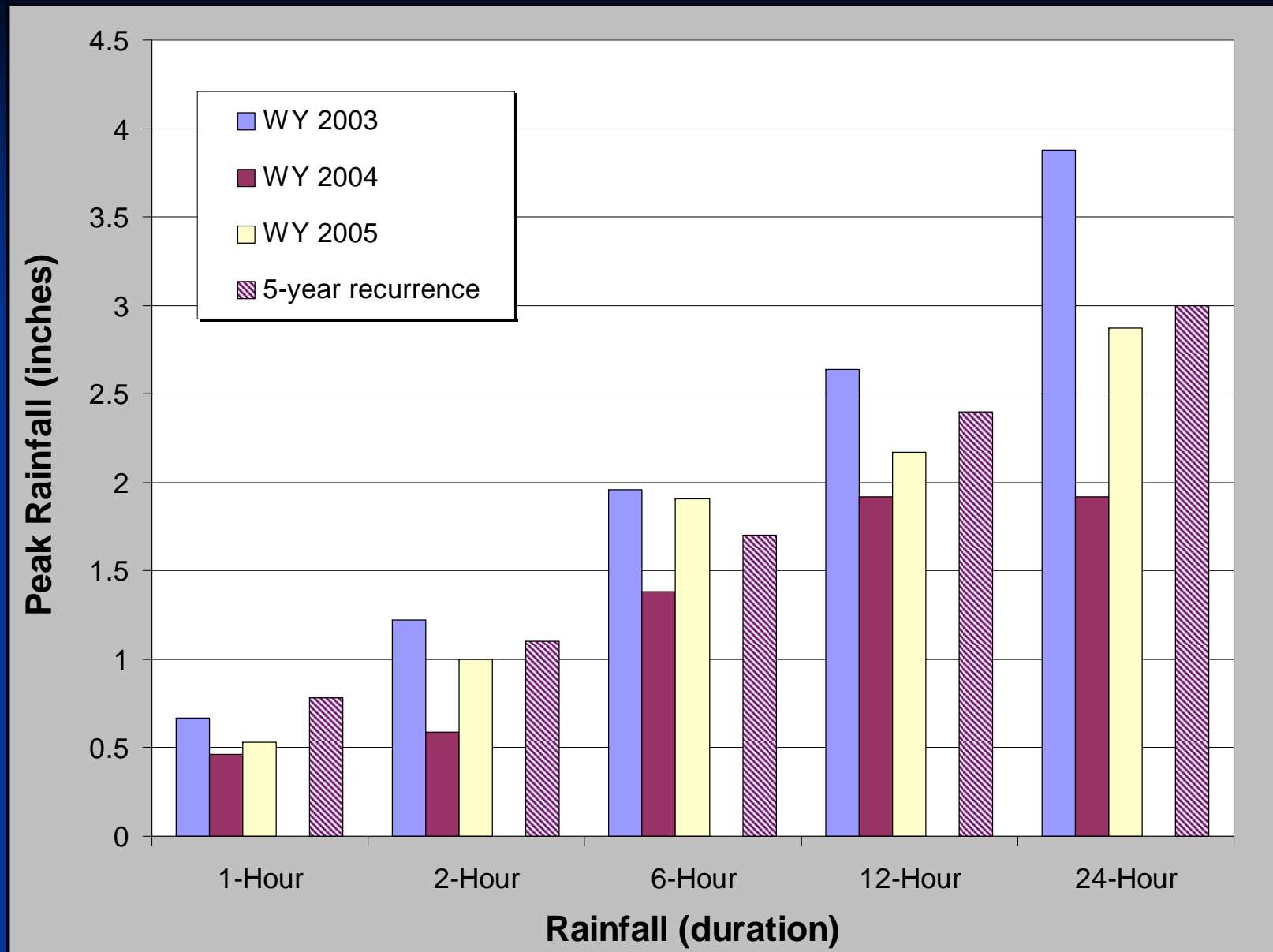
What is Hydromodification?

- Increases in peak flow and/or runoff volume caused by a hydrologic disturbance within the watershed
 - Often associated with urbanization
- What are the “important flows?”
 - Moderate, high-frequency flows
- Urbanization creates:
 - Increased runoff
 - Decreased infiltration
 - Excess streamflows

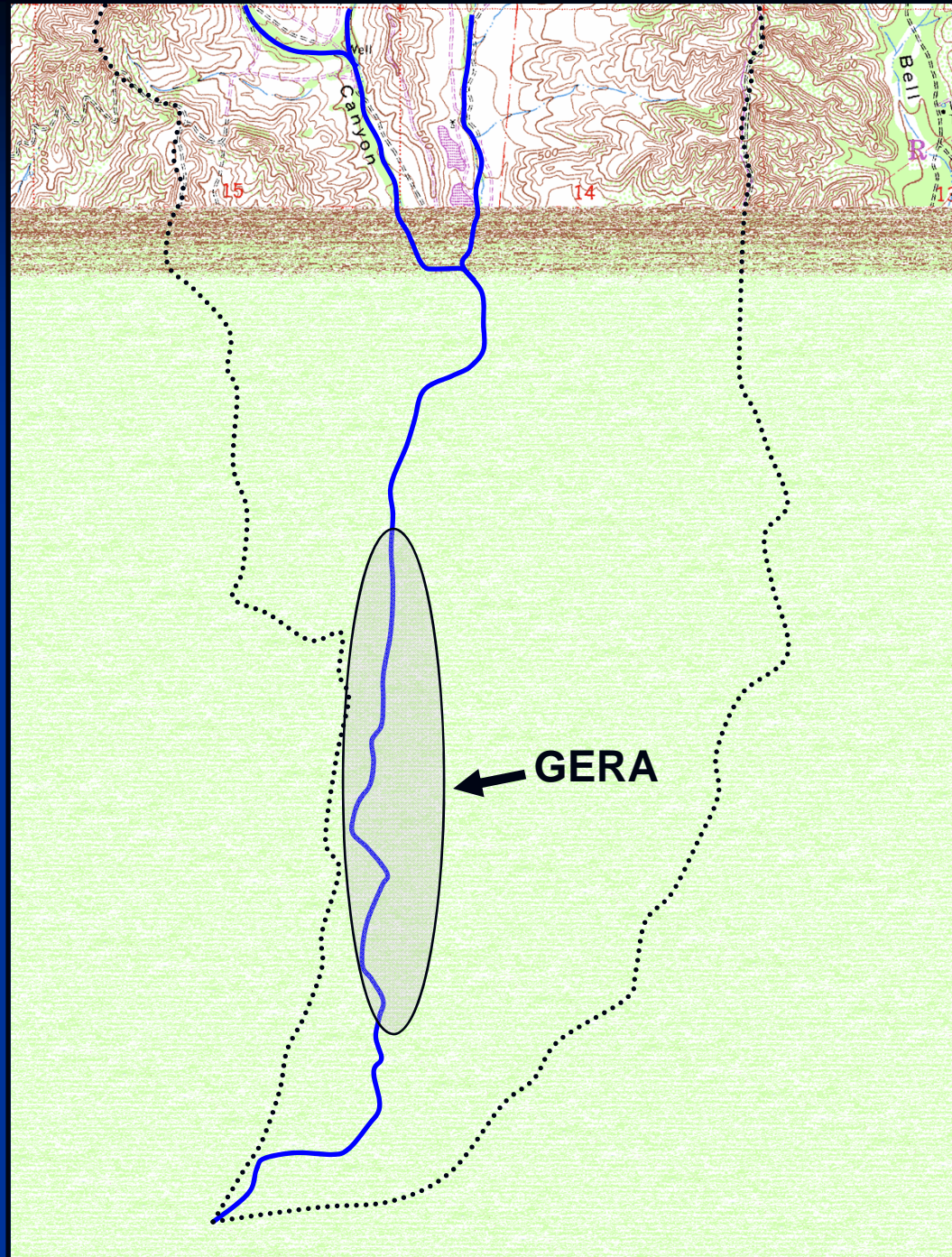


Study Site

- Gobernadora Canyon
 - Sandy canyon floor composed primarily of alluvium and debris flow deposits
 - Very little gravel or cobbles in the system
- Coto de Caza
 - Mid-density suburban/golf course development
 - Built in several stages through the 1990s
 - Built to control ~25-year flood events
- Gobernadora Ecological Restoration Area (GERA)



**5-year recurrence based on Orange County Hydrology Manual*



Channel response



March, 2003

Channel response



March, 2003

Channel response



March, 2004

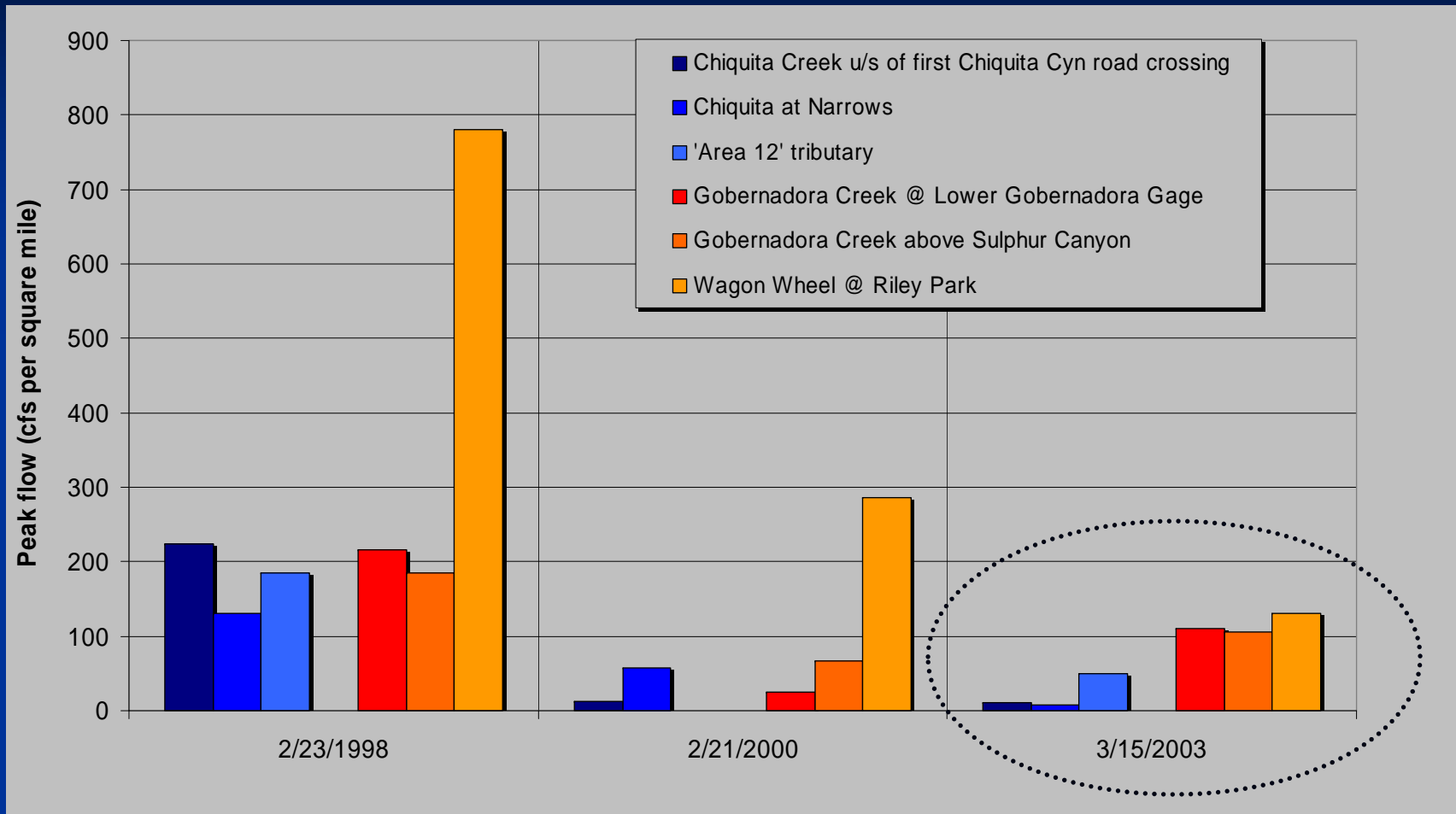
Channel response

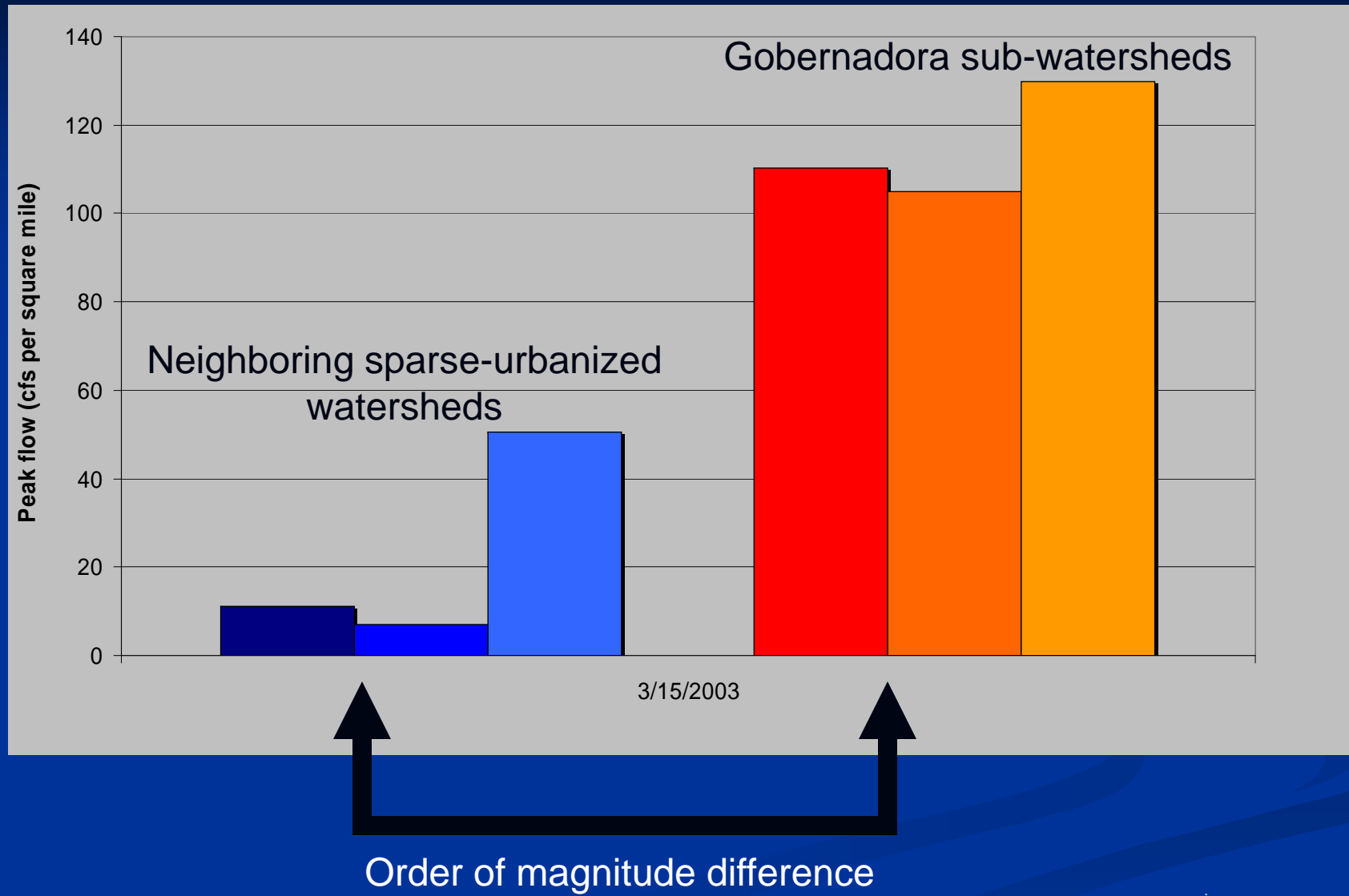


March, 2005

Why such a marked response?

- Sandy watershed
 - Very high natural infiltration
 - Large additions of impervious surfaces
 - Pre-urbanization—only partial drainage integration
- Unconsolidated valley fill
 - Easily erodible
- Falling base-level at canyon confluence
 - Gravel mining
- Feedback in incised reaches





Conclusions

- Hydromodification response can be especially rapid and prominent in sandy watersheds
- Engineering geologists should anticipate incision in downstream reaches and recognize the susceptibility of receiving water channels
- Sand-bedded streams are highly prone to incision, and should be treated differently than the gravel/cobble dominated systems that are more prevalent in Southern California

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY
REQUEST FOR PUBLIC ASSISTANCEO.M.B. No. 1660-0017
Expires October 31, 2008**PAPERWORK BURDEN DISCLOSURE NOTICE**

Public reporting burden for this form is estimated to average 10 minutes. Burden means the time, effort and financial resources expended by persons to generate, maintain, disclose, or to provide information to us. You may send comments regarding the burden estimate or any aspect of the collection, including suggestions for reducing the burden to: Information Collections Management, U.S. Department of Homeland Security, Federal Emergency Management Agency, 500 C Street, SW, Washington, DC 20472, Paperwork Reduction Project (OMB Control Number 1660-0017). You are not required to respond to this collection of information unless a valid OMB number appears in the upper right corner of this form. **NOTE: Do not send your completed questionnaire to this address.**

APPLICANT (Political subdivision or eligible applicant.)

DATE SUBMITTED

Santa Margarita Water District FEMA 059-1C6FF-00 (CA P.A. No. 059-91038) February 10, 2011

COUNTY (Location of Damages. If located in multiple counties, please indicate.)

Orange County California SMWD DUNNS Number 072528813

APPLICANT PHYSICAL LOCATION

STREET ADDRESS

26111 Antonio Parkway

CITY

Rancho Santa Margarita

COUNTY

Orange County

STATE

CA

ZIP CODE

92688

MAILING ADDRESS (If different from Physical Location)

STREET ADDRESS

POST OFFICE BOX

7005

CITY

Mission Viejo

STATE

California

ZIP CODE

92690-7005

Primary Contact/Applicant's Authorized Agent**Alternate Contact**

NAME

Ron H. Meyer

NAME

Daniel R. Ferons

TITLE

Engineering Associate

TITLE

Chief Engineer

BUSINESS PHONE

(949) 459-6594

BUSINESS PHONE

(949) 459-6590

FAX NUMBER

(949) 589-6243

FAX NUMBER

(949) 459-6463

HOME PHONE (Optional)

HOME PHONE (Optional)

CELL PHONE

CELL PHONE

E-MAIL ADDRESS

ronm@smwd.com

E-MAIL ADDRESS

danf@smwd.com

PAGER & PIN NUMBER

PAGER & PIN NUMBER

Did you participate in the Federal/State Preliminary Damage Assessment (PDA)? ☐ Yes☒ No

Private Non-Profit Organization?



Yes



No

If yes, which of the facilities identified below best describe your organization? utility (water & waste water) FEMA 059-1C6FF-00 (CA P.A. No. 059-91038)

Title 44 CFR, part 206.221(e) defines an eligible private non-profit facility as: "... any private non-profit educational, utility, emergency, medical or custodial care facility, including a facility for the aged or disabled, and other facility providing essential governmental type services to the general public, and such facilities on Indian reservations." "Other essential governmental service facility means museums, zoos, community centers, libraries homeless shelters, senior citizen centers, rehabilitation facilities, shelter workshops and facilities which provide health and safety services of a governmental nature. All such facilities must be open to the general public."

Private Non-Profit Organizations must attach copies of their Tax Exemption Certificate and Organization Charter or By-Laws. If your organization is a school or educational facility, please attach information on accreditation or certification.

Official Use Only: FEMA-____-DR-____-____ FIPS# _____

Date Received:

State of California
OFFICE OF EMERGENCY SERVICES

059-91038

OES ID No.: _____

PROJECT APPLICATION FOR FEDERAL ASSISTANCESUBGRANTEE'S NAME: Santa Marguerita Water District
(Name of Organization)ADDRESS: P.O. Box 7005CITY: Mission ViejoSTATE: CAZIP CODE: 92690-7005TELEPHONE: 949-459-6590FAX NUMBER: 949-459-6463AUTHORIZED AGENT: Daniel R. FeronisTITLE: Chief EngineerEMAIL ADDRESS: danf@smwd.com**ASSURANCES - CONSTRUCTION PROGRAMS**

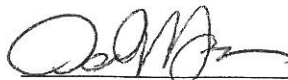
Note: Certain of these assurances may not be applicable to all of your projects. If you have questions, please contact the Governor's Office of Emergency Services. Further, certain federal assistance awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant I certify that the subgrantee named above:

1. Has the legal authority to apply for federal assistance, and the institutional, managerial and financial capability (including funds sufficient to pay the non-federal share of project costs) to ensure proper planning, management and completion of the project described in this application.
2. Will give the awarding agency, the Comptroller General of the United States, and if appropriate, the state, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the assistance; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.
3. Will not dispose of, modify the use of, or change the terms of the real property title, or other interest in the site and facilities without permission and instructions from the awarding agency. Will record the federal interest in the title of real property in accordance with awarding agency directives and will include a covenant in the title of real property acquired in whole or in part with federal assistance funds to assure nondiscrimination during the useful life of the project.
4. Will comply with the requirements of the assistance-awarding agency with regard to the drafting, review and approval of construction plans and specifications.
5. Will provide and maintain competent and adequate engineering supervision at the construction site to ensure that the complete work conforms with the approved plans and specifications and will furnish progress reports and such other information as may be required by the assistance awarding agency or state.
6. Will initiate and complete the work within the applicable time frame after receipt of approval of the awarding agency.
7. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gains.
8. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§ 4801 et seq.), which prohibits the use of lead based paint in construction or rehabilitation of residence structures.
9. Will comply with all federal statutes relating to nondiscrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§ 1681-1683 and 1685-1686) which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794) which prohibit discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. §§ 6101-6107) which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 93-255) as amended, relating to nondiscrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616) as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§ 523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. 290 dd-3 and 290 ee-3), as amended, relating to confidentiality of alcohol and drug abuse patient records;

- (h) Title VIII of the Civil Rights Act of 1968 (42 U.S.C. § 3601 et seq.), as amended, relating to nondiscrimination in the sale rental or financing of housing; (i) any other nondiscrimination provisions in the specific statute(s) under which application for federal assistance is being made, and (j) the requirements on any other nondiscrimination statute(s) which may apply to the application.
10. Will comply, or has already complied, with the requirements of Titles II and III of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provides for fair and equitable treatment of persons displaced or whose property is acquired as a result of federal and federally assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of federal participation in purchases.
 11. Will comply with the flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is \$5,000 or more.
 12. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.O. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved state management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§ 1451 et seq.); (f) conformity of federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. § 7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended, (P.L. 93-523); and (h) protection of endangered species under the Endangered Species Act of 1973, as amended, (P.O. 93-205).
 13. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§ 1271 et seq.) related to protecting components or potential components of the national wild and scenic rivers system.
 14. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), EO 11593 (identification and preservation of historic properties), and the Archaeological and Historic Preservation Act of 1974 (16 U.S.C. 469a-1 et seq.).
 15. Will comply with Standardized Emergency Management (SEMS) requirements as stated in the California Emergency Services Act, Government Code, Chapter 7 of Division 1 of Title 2, Section 8607.1(e) and CCR Title 19, Sections 2445, 2446, 2447 and 2448.
 16. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act of 1984 and the Single Audit Act Amendments of 1996.
 17. Will comply with all applicable requirements of all other federal laws, Executive Orders, regulations and policies governing this program.
 18. Has requested through the State of California, federal financial assistance to be used to perform eligible work approved in the subgrantee application for federal assistance. Will, after the receipt of federal financial assistance, through the State of California, agree to the following:
 - a. The state warrant covering federal financial assistance will be deposited in a special and separate account, and will be used to pay only eligible costs for projects described above;
 - b. To return to the State of California such part of the funds so reimbursed pursuant to the above numbered application, which are excess to the approved actual expenditures as accepted by final audit of the federal or state government.
 - c. In the event the approved amount of the above numbered project application is reduced, the reimbursement applicable to the amount of the reduction will be promptly refunded to the State of California.
 19. Will not make any award or permit any award (subgrant or contract) to any party which is debarred or suspended or is otherwise excluded from or ineligible for participation in Federal assistance programs under Executive Order 12549 and 12689, "Debarment and Suspension."

The undersigned represents that he/she is authorized by the above named subgrantee to enter into this agreement for and on behalf of the said subgrantee.



SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL

Chief Engineer

February 10, 2011

OES 89 (Rev 1/05)

TITLE

DATE

P.A. No.: 059-91038


**DESIGNATION OF
APPLICANT'S AGENT RESOLUTION**

BE IT RESOLVED BY THE Board of Directors OF THE Santa Margarita Water District
(Governing Body) (Name of Applicant)
THAT Chief Engineer, OR
(Title of Authorized Agent)
Operations Manager, OR
(Title of Authorized Agent)
General Manager
(Title of Authorized Agent)

is hereby authorized to execute for and in behalf of the Santa Margarita Water District, a public entity established under the laws of the State of California, this application and to file it in the Office of Emergency Services for the purpose of obtaining certain federal financial assistance under P.L. 93-288 as amended by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988, and/or state financial assistance under the Natural Disaster Assistance Act.

THAT the Santa Margarita Water Dist, a public entity established under the laws of the State of California, hereby authorizes its agent(s) to provide to the State Office of Emergency Services for all matters pertaining to such state disaster assistance the assurances and agreements required.

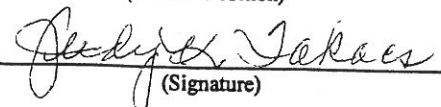
Passed and approved this 15th day of January, 19 99


Sandra Jacobs (Name and Title) President
(Name and Title)
(Name and Title)

CERTIFICATION

I, Judy K. Takacs, duly appointed and Secretary of
(Name) (Title)
Santa Margarita Water District, do hereby certify that the above is a true and correct copy of a
resolution passed and approved by the Board of Directors of the Santa Margarita Water Dist on the
(Governing body) (Name of Applicant)
15th day of January, 19 99.

Date: January 15, 1999

Secretary
(Official Position)

(Signature)



Cal EMA
CALIFORNIA EMERGENCY
MANAGEMENT AGENCY

For Internal Use Only
Cal EMA APPLICATION NO.: _____
DISASTER NO.: _____

PROJECT APPLICATION
CALIFORNIA DISASTER ASSISTANCE ACT PROGRAM

1. APPLICANT'S NAME AND ADDRESS

APPLICANT Santa Marguerita Water District
ADDRESS P.O. Box 7005
CITY & ZIP Mission Viejo, CA 92690-7005
PHONE (949) 459-6590

2. APPLICANT'S AUTHORIZED AGENT

(Attach Resolution of Designation unless an accurate "universal" resolution is on file.)

NAME Daniel R. Feronis
TITLE Chief Engineer
ADDRESS Same
CITY & ZIP Same
PHONE (949) 459-6590
FACSIMILE (949) 459-6463
E-MAIL danf@smwd.com

3. PROJECT SUMMARY – Attach a List of Projects as defined in Title 19 of the California Code of Regulations, Section 2970(a)(4).

ASSURANCES AND AGREEMENTS

- A. The applicant certifies (to the best of his knowledge and belief) the disaster relief work herein described for which state financial assistance is requested, is eligible in accordance with the criteria contained in the Disaster Assistance Act (Government Code, Section 8680 et seq.)
- B. The applicant is the legal entity responsible under law for the performance of the work detailed and accepts such responsibility.
- C. The applicant certifies that the disaster relief work herein described for which state assistance is requested hereunder does not, or will not duplicate benefits received for the same loss from another source.
- D. The applicant certifies that they have undertaken to recover maximum federal participation in funding street and highway project and public facility projects.
- E. The applicant certifies that all information given herein is to the best of its knowledge and belief, true and correct.
- F. The applicant agrees to (1) provide without cost to the state all lands, easements, and rights-of-way necessary for accomplishment of the approved work;
(2) hold and save the State of California, its officers, agents and employees free from damages due to the approved work.
- G. (1) The applicant agrees to comply with Section 3700 of the Labor Code which requires every employee to be insured against liability for Workmen's Compensation, or to undertake self insurance in accordance with provisions of the code; and will comply with such provisions before commencing the performance of the work.

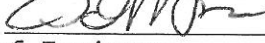
(2) The applicant agrees to comply with the Fair Practices Act in connection with the performance of work under this agreement wherein it agrees it will not willfully discriminate against any employee or applicant for employment because of race, color, religion, ancestry, sex, age or national origin; and it agrees to take affirmative action to insure that applicants for employment are employed, and that employees are treated during employment, without regard to their race, color, religion, ancestry, sex, age or national origin, and hereby gives assurance that it will immediately take any measures necessary to effectuate this agreement.

(3) If any real property or structure thereon is provided or improved with the aid of the state financial assistance extended to the applicant, this assurance shall obligate the applicant, or in the case of such property, any transferee for the period during which the provision of similar services of benefits. If any personal property is so provided, this assurance shall obligate the applicant for the period during which it retains ownership or possession of the property. In all other case, this assurance shall obligate the applicant for the period during which the state financial assistance is extended to it by the agency.

- (4) This assurance is given in consideration of, and for the purpose of obtaining any and all state grants, loans, reimbursement, advances, contracts, property, discount, or other state financial assistance extended after the date hereon to the applicant. The applicant recognizes and agrees that such state financial assistance will be extended in reliance on the representations and agreements made in this assurance and that the state shall have the right to seek judicial enforcement of this assurance. This assurance is binding on the applicant, its successors, transferees and assignees, and a person or persons whose signatures appear on the reverse, or authorized to sign this assurance on behalf of the applicant.
- H. The applicant certifies that all financial assistance received under this application will be, or has been expended in accordance with applicable laws and regulations. The applicant certifies that any work performed by a state agency at their request shall be agreed upon in writing and be subject to the State Contract Act. The applicant certifies that the work performed, or to be performed is in accordance with the state and local laws governing the performance of such work.
- I. The applicant certifies compliance with Standardized Emergency Management (SEMS) requirements as stated in the California Emergency Services Act, Government Code, Chapter 7 of Division 1 of Title 2, Section 8607.1(e) and CCR Title 19, Section 2445, 2446, 2447 and 2448.
- J. The applicant certifies that on contracts involving expenditures in excess of \$25,000, it obtained from the contractor a payment bond in accordance with Sections 3247 through 3252 of the Civil Code.
- K. **BY ACCEPTING THESE FUNDS, THE APPLICANT IS NOT FORFEITING ANY RIGHTS WHATSOEVER, INCLUDING THE RIGHT TO A FAIR HEARING.**

4. SIGNATURE OF APPLICANT'S AUTHORIZED AGENT

(Indicates concurrence with assurances and agreements)

SIGNATURE: 
TITLE: Chief Engineer

DATE: February 10, 2011

5. Cal EMA APPROVALSIGNATURE: _____
TITLE: _____

DATE APPROVED: _____

List of Projects

APPLICANT: Santa Margarita Water District P.A. No. 059-91038 (FEMA 059-1C6FF-00) DATE COMPLETED: February 10, 2011

CONTACT NAME AND PHONE NUMBER: Ron Meyer, Ronm@smwd.com (949)459-6594 IS THIS AN AMENDED LIST OF PROJ No

ITEM #	DR -1952 Location	DESCRIPTION OF DAMAGE AND SCOPE OF WORK	COST ESTIMATE	CATEGORY*	WAS WORK COMPLETED BY FORCE ACCT. (FA), CONTRACT (C) OR BOTH (F/C)?	ENTER "ENV" IF THERE ARE ENVIRONMENTAL ISSUES OR "HIST" FOR HISTORIC ISSUES, OR BOTH	WAS THERE INSURANCE COVERAGE? IF YES, ENTER DEDUCTIBLE AMOUNT	WAS THE FACILITY DAMAGED IN A PRIOR DISASTER(S)? IF YES, ENTER DISASTER NAME(S) OR NUMBER(S)	ARE THERE COST EFFECTIVE HAZARD MITIGATION MEASURES THAT MAY PREVENT FUTURE DAMAGE?
1	Upper Chiquiat Reservoir	LandSlides	\$810,000	A/D	C	No	No	No	No
2	Gobernadora Creek/Ortega Force Main	Flooding and erosion	\$310,000	A/E	F/C	No	No	No	Yes
			\$						
			\$						
			\$						
			\$						
			\$						
			\$						

*CATEGORY: A) Debris Clearance; B) Protective Measures; C) Road System; D) Water Control Facility; E) Buildings and Equipment; F) Public Utility System; G) Other. (Note: if a single site has more than one category, indicate the category that represents the majority of damage.)

EXHIBIT C

EROSION



EXHIBIT D

EROSION



4/13/2011

Att7_SWF_DReduc_2 of 2

Annual Precipitation Table

Gobernadora Multipurpose Basin Project

Cooperative Observer Rainfall Data

Santa Margarita Water District

Print

Close

Year to Date: Annual Daily Precipitation Accumulations

Note: Period times are 8:00 AM Pacific Standard Time

EXHIBIT E

Output 04/08/2011

Site SANTIAGOPEAK Santiago Peak
 Variable 11.01 Rainfall in Inches, Daily
 Figures are for period ending 800 hours.

Year 2010/11
 Table Type Rain

Day	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Day
1													1
2													2
3							0.31		0.04				3
4							0.21						4
5				0.12									5
6				0.24		0.24							6
7				0.16					0.12				7
8					0.43					0.20			8
9					0.04								9
10													10
11													11
12													12
13													13
14													14
15													15
16						0.20		0.55					16
17						0.04		0.87					17
18						2.80							18
19				0.04		2.09		1.26					19
20				0.75	0.94	4.57		1.44E	0.12				20
21					3.35	6.42			1.93E				21
22				0.04	0.16	5.04			0.39				22
23						1.18							23
24				0.04	0.94B				0.45				24
25				0.63					0.22				25
26						0.47		2.17	0.35				26
27								0.04	0.04				27
28					0.12								28
29						0.16							29
30				0.31		1.14							30
31							0.43						31
Mean	0.00	0.00	0.00	0.08	0.20B	0.79	0.03	0.23E	0.12E	0.01	0.00	0.00	
Maximum	0.00	0.00	0.00	0.75	3.35B	6.42	0.43	2.17E	1.93E	0.20	0.00	0.00	
Minimum	0.00	0.00	0.00	0.00	0.00B	0.00	0.00	0.00E	0.00E	0.00	0.00	0.00	
Total	0.00	0.00	0.00	2.33	5.98B	24.35	0.95	6.33E	3.66E	0.20	0.00	0.00	

Summaries

Annual Mean 0.12E
 Annual Total 43.80E

Maximum Minimum
 Daily 6.42E 0.00E

----- Notes -----

All recorded data is continuous and reliable
 except where the following tags are used...
 B ... Partially Estimated
 E ... Estimated Data

EXHIBIT F**B.4. UNIT HYDROGRAPH METHOD DESIGN STORM**

The Orange County design storm shall be used for all unit hydrograph method calculations (Figures B-5a, b, c).

The point precipitation depths in Table B.2 shall be used for the single-day design storm.

For watersheds with detention basins, a multi-day storm shall be used as shown in Sections B.5 and B.6.

Due to the variations in point precipitation values between mountainous and nonmountainous areas, area averaging of rainfall is required when catchments include areas both above and below the 2,000-foot elevation.

TABLE B.2.
ORANGE COUNTY POINT PRECIPITATION DATA (inches)
DURATION

<u>T-YR.</u>	<u>5M</u>	<u>30M</u>	<u>1H</u>	<u>3H</u>	<u>6H</u>	<u>24H</u>
100	0.52(.78)	1.09(1.34)	1.45(1.94)	2.43(3.96)	3.36(6.19)	5.63(11.27)
50	0.45(.71)	0.98(1.19)	1.30(1.73)	2.19(3.52)	3.02(5.51)	5.07(10.02)
25	0.40(.63)	0.87(1.04)	1.15(1.51)	1.94(3.08)	2.71(4.81)	4.49(8.76)
10	0.34(.50)	0.72(.84)	0.95(1.22)	1.59(2.48)	2.20(3.87)	3.68(7.05)
5	0.26(.40)	0.59(.68)	0.78(.99)	1.31(2.01)	1.81(3.14)	3.03(5.71)
2	0.19(.26)	0.40(.45)	0.53(.66)	0.89(1.34)	1.22(2.09)	2.05(3.81)

NOTES:

- (1.) Numbers in () are from the Santiago Peak gage station #156, DWR depth-duration-frequency table (1983). Use in areas above 2,000 feet in elevation.
- (2.) Precipitation data for nonmountainous areas taken from an average of 25 rain gages (see ref. 7). Use in areas below 2,000 feet in elevation.
- (3.) All 5M values are extrapolations (see ref. 7).
- (4.) M = minutes; H = hours.

EXHIBIT G**SANTIAGO PEAK STATION #156 FLOOD EVENTS**

Exhibit G - Santiago Peak Station #156 Flood Events ⁽¹⁾		
T-YR.	24-H Rainfall (inches)	Notes
100	11.27	
50	10.02	
25	8.76	
10	7.05	Minimum flows to undermine utilities
5	5.71	
2	3.81	
Peak Rainfall 12-21-2010	6.42	Between a 5 and 10-year storm

(1) Source: National Oceanic and Atmospheric Administration, 2010.